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INCORPORATING PERSONALITY TRAIT PYSCHOLOGY INTO ECONOMIC DECISION MAKING MODELS

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INCORPORATING PERSONALITY TRAIT PYSCHOLOGY INTO ECONOMIC DECISION MAKING MODELS

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ABSTRACT

In this thesis, we compare the abilities of Big Five locus of personality traits, religiosity, risk aversion, contextual, and historical variables in explaining behavior in the Trust Game, the Minimum Effort Game, and a Cheap Talk Game. We find that that behavior in the games is largely explained by contextual and historical variables, with some influence from personality traits. This suggests that, while there is a role for personality traits in explaining behavior in economic settings, most variation is explained by the context of economic interactions and the results of previous interactions.

DEDICATION

Dedicated to my father, for being the best role model a son could ask for, and my mother, for proving to me that maternal love truly knows no bounds.

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CHAPTER ONE

INTRODUCTION

The aim of this thesis is to examine the roles played by personality trait theory and commonly used economic parameters toward the goal of explaining behavior in various economic settings. Specifically, we seek to explore the interplay of economic parameters and the Big Five model of personality. To explore this, we must first provide some background on both game theory and personality psychology.

The field of personality psychology seeks to construct sensible models for explaining similarities and differences in the way we are. As such, it is designed to present a comprehensive picture for explaining behavior. Theories of personality can themselves be divided into trait theories, type theories, psychoanalytic theories, behaviorist theories, social cognitive theories, humanistic theories, and biopsychological theories. These theories have been developed from different perspectives regarding the primary drivers of human behavior (Larson and Buss 2008).

We focus on trait theories, which are, according to the Diagnostic and Statistical Manual (DSM) of the American Psychiatric Association (APA), "enduring patterns of perceiving, relating to, and thinking about the environment and oneself that are exhibited in a wide range of social and personal contexts" (DSM-IV-TR 2000) A properly defined trait is, then, one that is relatively stable over time, is part

of a comprehensive framework, varies along a continuum, and has the ability to consistently predict behavior in a large variety of settings.

There are, as would be expected, several varieties of trait theories. Some theories have as few as two traits, while others have as many as twenty one (Mathews et al 2009). We focus on the theory developed by Lewis Goldberg, among others, known colloquially as "The Big Five" or "The Five Factor Model." This model posits that there are 5 major dimensions to personality: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (OCEAN) (Goldberg 1990). We focus on this model largely because it is arguably the most dominant and widely known model from the personality psychology literature, and it is also the most general (Goldberg 1990).

Economic games can take many forms. Most broadly, games fall into 4 types stemming from two categories. Games are either static or dynamic, and either of complete or incomplete information (Gibbons 1992). A static game is one in which all moves are made simultaneously, while dynamic games require turn based decision-making. A game of complete information is one in which all pertinent information is made available to all participating parties, while incomplete information games necessitate that some players have more information than others (Gibbons 1992).

We prefer to divide games based on the real-world phenomena that we wish to explore. There exist a plethora of potentially interesting real-world situations we can explore with economic games. Choosing games of interest then largely becomes

a matter of those that generate phenomena we wish to explore, those that potentially have a role for the Big Five model of personality traits, and those that can be executed given the constraints of time.

As mentioned, we seek to explore the interplay of economic parameters and the Big Five model of personality. The roles the two play can be that of substitutes, complements, or neither (Borghans et al 2008). That is, either one approach will be predictive while the other will not, the two approaches will bolster one another's predictive power, or there will be no predictive power in either approach. Since the economist's approach has been fitted to explain behavior in their context, we should see predictive power from the parameters commonly used to explain behavior in their context. However, it could be the case that while the economist's approach works in individualized contexts, the personality psychology approach could be a more comprehensive model that can explain behavior in many or all games.

To explore this relationship, we deploy three games, a personality questionnaire, and a decision problem designed to elicit risk preferences. The three games provide the setting we explore, while the decision problem and the personality questionnaire are used to generate a risk aversion parameter and the score on the Big Five locus of personality traits, respectively. Specifically, the three games we select are the trust game, the minimum effort game, and a cheap talk game.

The trust game provides us a dynamic game of complete information, which explores the phenomena of altruism, reciprocity, trust, and risk aversion (Berg et al

1994). The minimum effort game is a dynamic game of complete information, which provides an environment to explore the phenomena of cooperation, coordination, and risk aversion (Van Huyck et al 1990). The cheap talk game is a dynamic game of incomplete information, which allows us to explore the phenomena of truth telling and trust (Dickhaut et al 1995). These games are played at varying lengths, once or repeatedly, which provides insight into the influence of history and reputation building, as well as the influence of knowledge that there will be no history, reputation building, or recourse. We also explore the role played by religiosity since all of the games incorporate some element of honesty, dishonesty, and trust, all of which may be impacted by religiosity. Finally, we also gather demographic information since previous literature in both game theory and personality psychology has shown than certain groups behave in systematically different ways in various contexts.

This thesis is organized as follows. In the Chapter 2 we present an overview of previously existing literature germane to our games of interest and personality research. We then describe the specific tools and measures used to explore our research questions in Chapter 3. Chapter 4 explains the method used in the present study. We then present the results of our analysis in Chapter 5, followed by Chapter 6, a discussion section in which we make more speculative remarks as to what our results suggest and outline a path for future research. Finally, an appendix contains the instructions used to guide participants in lab sessions, for reference.

CHAPTER TWO

REVIEW OF LITERATURE

We divide the literature review into several sections. These sections describe the literature relevant for each game played with a focus on providing a justification for our experiment design. Finally, we review literature that has combined insights from game theory and personality psychology.

Review of relevant trust game literature

Berg, Dickhaut, and McCabe (1995) is the origin of the Trust/Investment game. They set up two treatments, one with no history and one with. In the no history treatment, all matching is random and anonymous. In the treatment with history they use the results from the first treatment as a baseline for behavior norms. A $10 show up fee is given to people in one room who decide how much to send to counterparts in another room. Each dollar sent is tripled. Subjects in the second room decide how much of invested amount to send back. The unique Nash equilibrium prediction for this game with perfect information is for the first-mover to send nothing, and sub-game perfection shows that anything received by the second mover will be kept (stage two is a dictator game). A second, social history, treatment is also used in which subjects were given a summary of the no history results as part of their instructions.

From a rational choice perspective, subjects who sent money must have believed their expected return was positive. Trusting behavior can be thought of as an equilibrium of a repeated game through reputation building. Trust can also be

seen as an evolutionary stable strategy that emerges in evolutionary models, as studied by Guth and Kliment (1993), Guth *et al* (1993) and Cosmides and Tooby (1992). If the second-mover interprets first-mover's behavior as an attempt to use trust to improve the outcome for both parties then he is more likely to reciprocate.

In the no history treatment, first-movers sent an average of $5.16 and second-movers returns an average of $4.66. 5/32 sent entire amount, 2/32 sent nothing, with a great amount of variation in-between. Among second-movers, 12/28 returned nothing, while 11/28 returned more than their partners sent giving the first-mover a positive net return. There was no correlation between amount sent and payback decisions. We employ a modified form of this game for our experiment.

Ben-Ner and Halldorsson (2009) seek to clarify what is trusting and trustworthiness. They define trusting as the inclination of one person to believe another person will cooperate for his benefit and will not take advantage of him if the opportunity arises. Specifically, trusting is defined with three qualities: (1) B will not take advantage of the situation to make a gain while imposing a loss on A, (2) B will not act maliciously towards A, (3) B will be willing to make small sacrifices for A, and (4) B is competent to act favorably towards A. In the trust game, trusting is measured as the amount A sends. Trustworthiness, then, is the willingness of a person B to act favorably towards A, when A has an expectation of reciprocity from B, and is defined as the amount B returns.

Ben-Ner and Halldorsson focus on a set of qualities that may be correlated with trusting and trustworthiness. These qualities are optimism/pessimism, faith in

God, altruistic and reciprocal tendencies, beliefs about the honesty of others, attitudes towards fairness, and risk attitudes.

Their results are as follows. The average amount sent in the trust game was $5.47 out of $10. They find evidence of a strong relationship between demographics and the four measures of interest. More agreeable, more extroverted, less conscientious, and less neurotic seem to be more trusting. Females exhibit greater amounts of trusting in surveys. Optimism is correlated with survey measures but not with amount sent. Altruism is positively associated with amount sent but insignificantly with survey measures. Risk-aversion survey and lottery measures show no statistically significant relationship with any measures. Faith in God has a small relationship with some survey measures, but not amount sent. They find little relationship between risk attitudes and the various measures of trusting they use. We further explore several of these relationships in our experiment.

They further find a moderate relationship between demographics and all four measures, particularly between the proportion returned and a Machiavellian scale, a scale that measures the degree to which a subject remains cool and detached towards the end of deceiving and manipulating others. They find negative relationships between the Machiavellian scale and agreeableness, extroversion, openness to experience and conscientiousness.

Only 40 cents of each dollar sent are explained by the amount sent in the dictator game so the rest is attributed to an investment motive among people who want to maximize profits and are willing to trust to do so. Since risk aversion seems

to be determined by factors that are different than those that determine amount sent, it suggests that these measure different things. They cannot explain trustworthiness with reciprocity or altruism since it is not related to the amount sent or to the reciprocity variable. They use this to infer that proportion returned reflects a sense of obligation to reward the trustor's investment, i.e., trustworthiness. The positive effect of agreeableness further suggests this relationship. Those who rank low on agreeableness, openness to experience, extraversion, and conscientiousness, but high on cognitive ability have a greater tendency to "cheat". However, such Machiavellian effects disappear after controlling for birth/childhood factors. Thus, proportion sent back seems to be a good measure of trustworthiness and there appear to be no good survey measures found to capture trustworthiness.

They conclude that the trust game is indeed a good measure of trusting and trustworthiness. Most of the variation of behavior in the game is explained by gender with weaker influence from personality traits. The facets captured by surveys appear heavily influenced by personality traits. The best predictor of trustworthiness appears to be agreeableness. We aim to replicate several of these findings in our experiment.

Evans and Revelle (2008) seek to challenge the finding of economists that trust is largely situational. They use a self-constructed Propensity to Trust Survey (PTS) to elicit a disposition known as propensity to trust and assess its validity using the Trust game with a multiplier, the number that the amount sent is

multiplied by before reaching the receiver, of three. They study trusting and trustworthiness as constructs that complement the Big Five model of personality traits. The trait of trust is often treated as a sub-scale of agreeableness (Digman 1990; Goldberg 1990). They use two studies: (1) the PTS is used to predict the Big Five and (2) the PTS is used as a predictor of trusting behavior in the Trust Game.

Trusting was positively associated with agreeableness and extraversion and negatively with neuroticism. Trustworthiness was positively related to agreeableness, conscientiousness, and openness to experience. Trusting and trustworthiness were themselves very weakly correlated. Multiple regressions on trusting found that it was positively related to extraversion and negatively related to neuroticism. Multiple regressions on trustworthiness showed it was predicted by agreeableness and conscientiousness.

In a second study, subjects were assigned to sender only, receiver only, or simultaneous conditions. They found that amount sent increased with agreeableness and trusting, however, agreeableness was no longer significant in a model that included trusting and adding trusting increased the predictive power of the model by 51%. Trusting and amount returned were positively correlated and significant at a 0.05 level in the receiver only condition. In the simultaneous condition, PTS and Big Five were both unrelated to amount returned.

They use their results to make the following conclusions. The PTS measure for trusting predicts sending money in the Trust Game and that this measure is a better predictor than the Big Five. The disposition of trusting, rather than

trustworthiness, predicted returning money. This may be because high trustors are more likely to interpret the game as a reciprocal exchange. They also find from the condition comparison that participants were more likely to invest when they were in a symmetric situation. Further, playing both roles discouraged investment. The amount sent in the first rounds was negatively correlated with the amount returned in the second round. Perceptions of fairness also seem to matter in that those who previously invested $5 or more were unlikely to return any money in the second round, and vice versa. They were also unlikely to return money to a partner who had shown less trust than they had, which suggests perception of fairness matter more than underlying dispositions. We further explore these relationships in our study.

Johnson and Mislin (2011) analyzed 162 replications of a variety of the Berg, Dickhaut, and McCabe Trust game to identify the effect of experimental protocols and geography. They use the following variables to predict amount sent and received: (1) Amount at stake, which is defined as the endowment of the sender; (2) Receiver endowment; (3) Rate of return, which is the multiplier applied to the amount sent, and a multiplier of 2 or 3; (4) Whether or not participants played the role of both sender and receiver, or just one; (5) Random payments, where a random payment is a condition where the subject payment is not systematically related to decisions made in the game; (7) Strategy method, which is where participants are initially asked to state how they would respond to each possible decision made by their partner, or otherwise; (8) Whether or not participants are

anonymous; (9) Whether or not the study is double-blinded; (10) Whether or not subjects were students. Finally, geographical information is also analyzed to see if systematic differences exist when the game is played in different regions.

They find that whether payment is random exhibits a robustly significant and negative effect on amount sent. Playing against a real person has a significant positive impact on amount sent. Double-blindness does not exhibit any effect. The effects of receiver endowment and anonymity have mixed effects. Concerning geography, they find that subjects in Africa send less than North Americans. There is a consistent tendency to return more when more is sent. Student populations return, on average, 0.8 standard deviations less than adult subjects. Players engaging in both roles in different rounds has a negative impact on trustworthiness. Stakes do not appear to influence behavior in the game in that sender endowment size has no impact on trusting or trustworthiness. When the amount sent is doubled rather than tripled, the proportion returned declines less than proportionately, that is, reciprocity decreases as the multiplier increases. This suggests an explanation that when the rate or return is high, receivers interpret sender decisions as investments, rather than altruism or inequity concerns. We use this meta-analysis to construct some of the hypotheses in our experiment.

Burks, Carpenter, and Verhoogen (2002) focus on the effect of playing both roles against the control of playing just one in the trust game. In one treatment, subjects find out they will play the receiver role only after having played the sender role. In the second treatment, they know in advance that they will play both roles.

Their primary result is that having subjects play both roles reduces both the amount sent as well as the amount sent back, i.e., trusting and trustworthiness. This effect exhibits itself only when subjects are informed that they will be playing both roles. They further explore how variation in behavior is explained by a variety of survey questions.

They find no statistically significant difference between the control treatment of playing just one role and the no prior knowledge of playing both roles treatment. Comparing the no prior knowledge treatment with the prior knowledge treatment reveals a result significant at the 0.01 level in the direction of people trusting less when they know they will play both roles. When people are aware they will play both roles, they return very little if anything, that is, trusting does not pay.

Review of relevant minimum effort game literature

Van Huyck, Battalio, and Beil (1990) were the first to create the minimum effort game set up. Players play a symmetric game where $\pi(e_i, e_{-i}) = a[\min(e_i, e_{-i})] - b(e_i)$. The parameter, a, can be thought of as technological efficiency, b can represent the opportunity cost of putting effort into joint production, technology is Leontief and a > b > 0. The game has symmetric Nash-equilibria in pure strategies when all e's are equal and equilibria can be Pareto ranked. Explicit coordination is not permitted. Since payoffs are increasing in the minimum effort, all players prefer the highest minimum, but there is incentive to choose lower effort levels if other players make mistakes. There is riskiness in increasing the group size in that the probability that the minimum effort is 1 goes to

1 as group size goes to infinity, cetaris paribus, because with a probability of making a mistake greater than zero, at least one participant will make a mistake. A more risk averse person will select lower efforts.

In some treatments, participants were allowed to make predictions and they found that predictions about expected behavior matched actual behavior, that is, those that made optimistic prediction chose higher effort levels than those who made pessimistic predictions.

The evolution of behavior also raises interesting issues as initially players can use only intuition to predict behavior. However, as players play repeatedly, their effort choices can be guided by results from previous rounds. They find that repeating the game leads to convergence to a stable outcome. Though the level of convergence varies from group to group, the general trend is downward; by round 10, 72% of subjects adopt the secure action of choosing the minimum possible effort.

In the third treatment, group size is reduced to 2. As expected, since there is now less risk in choosing a higher effort, coordination at higher levels is found. 42% of groups chose the maximum effort level and 74% of subjects chose a higher effort level than they did in the larger group, averaging over rounds. We use this experiment to guide our selection of payoff function parameters, group size, and the number of rounds.

Knez and Camerer (1994) chose a setup where several rounds of the game were played by 3 person groups for 5 rounds. The minimum was made known. Each

subject guessed what they thought the minimum would be in each round and were rewarded if they guessed correctly. In next 5 rounds, group i and j were combined into 6 person groups.

They find that aggregating from 3 to 6 person groups lowers the minimum action and lowers efficiency. There is also a general tendency to the lowest possible minimum as was seen in Van Huyck et al. (1990). By the final period 26/30 subjects chose the minimum, while the other four chose and effort of 2. They find moving from 2 to 3 person group has the biggest harm on efficiency. We select the number of rounds played as well as group size based on these findings

The number of repetitions is an important determinant for equilibrium selection. Berninghaus and Ehrhart (1998) hypothesize that when players know there are many repetitions, they are more patient and tolerant in seeking coordination on the Pareto best equilibrium. They set a payoff function of $\pi_i(e_i) = 10 + 2 * \min[e_1,...,e_8] - e_i$ and $e \in [1,...,9]$ so there are 9 symmetric Nash equilibria. They find when the number of repetitions is equal to 10, Pareto worst choices were selected, when it is 90, Pareto best choices were made, when it is 30, either outcome may occur. They hypothesize players exhibit a degree of tolerance when there are a large number of repetitions remaining. We use these results to guide number of round selection, as well as highlighting potential predictors to explore.

Goeree and Holt (1999) examine the effect of the costs of effort in the minimum effort game. They focus on single period minimum effort games with

groups of randomly matched subjects who make effort selections. The payoff is $\pi_i = (e_1,...,e_n) = \min(e_1,...,e_n) - ce_i$ where $i = 1,...,n.$ c represents effort cost. As long as c is less than 1, payoffs are maximized when all players choose the highest possible effort and there is a Nash equilibrium at any common effort level, so non critical changes will not alter the Nash equilibria with pure strategies. The low effort equilibrium is risk-dominant when the cost of effort is sufficiently high.

In a two person experiment, subjects are allowed to choose effort levels continuously between [110, 170]. The cost parameter was set at ¼ for one treatment and ¾ for another. This change does not alter the theoretical predictions of theories based on best-responses to others' decisions. Subjects played 10 periods with random pairings. After each period, players were informed of their own earnings and the other person's decision. Three sessions were conducted in the high cost treatment (c=3/4) and three were conducted in the low cost treatment (c=1/4).

They find the averages of all sessions begin near the midpoint of the range. In the low cost sessions, effort levels started around the midpoint and then steadily trended upwards. In the high cost sessions, effort choices began in the middle and trended down toward lower effort choices. They reject the null hypothesis of no treatment effect at a 5% level of significance. Another two sessions were run that lasted 20 rounds with similar results.

They then move from two to three player groups, with low cost sessions having a c=0.1 and a high cost session equal to c=0.5 so that n*c is greater than 1 in the high cost treatment and less than 1 in the low cost treatment. They find that in

the low-cost session, decisions begin slightly above the midpoint of effort choices and then trend upwards and reach and stay at the maximum effort. In the high cost session, effort choices begin slightly above the midpoint, but steadily trend downward. We use this paper to generate an appropriate cost parameter in our minimum effort game.

Review of relevant "Cheap Talk" literature

Dickhaut, McCabe, and Mukherji (1995) set up a game in which a Sender is given private information about the state of nature and sends a message to a receiver who selects an action that determines the outcome for both parties. The outcomes are arranged in a way such that the sender and receiver's preferences over states and actions diverge. A similarity parameter is used to measure the degree to which preferences diverge. A high similarity parameter implies preferences are not aligned and vice versa.

They arrange 4 different states, all of which are equally likely to occur, as well as 4 different possible action selections. The messages available to the sender range from complete truth telling about the state of nature, and then increasing levels of misrepresentations regarding the state of nature, though messages can be sent in tandem such that a message of {1, 2} is a message stating either state 1 or state 2 is equally likely.

They find the following results. They find when preferences are less aligned, the ability of the receiver to infer the state from the message is progressively impaired. Consistent with this, they find receivers' payoffs decrease as preferences

diverge, which means coordination is less likely to be achieved. We will control for the impact of incentives on truth telling behavior by senders, as incentive to lie results in lowered coordination.

Crawford (1997) surveys cheap talk games, games in which players' messages are communicated regarding payoffs, but do not directly impact payoffs. He analyzes a variety of experimental designs. He claims an ideal design is one in which the environment is controlled, a population is paired repeatedly, randomly, anonymously, subjects are told the outcome after each round to observe the effect of learning, clear instructions, and subjects are paid according to their earnings in the game. This helps us establish a baseline for our experiment setup.

Gneezy (2005) constructs a 2-person interaction game in which lying increases payoffs to the liar at the expense of his partner to see how changes in relative payoffs impact the sender's decision as to whether or not to lie. Gneezy's setup is the setup that most closely resembles our own design. His game has two possible states and two possible messages. The states regard two possible payoffs while the messages proclaim either one option contains a better result for the receiver or the converse. When incentives are aligned, the equilibrium is truth telling. When incentives do not align, there are only mixed strategy equilibria.

Absolute and relative consequences of lies are varied and the effect of this is measured on the propensity to lie. He further uses a questionnaire to elicit subjects' opinions regarding lying. Sender's beliefs regarding the effect of the message are of interest. To elicit this, senders are asked to guess how the receiver would react to

their message. Thus, if sender's believe their message will be heeded, and incentives are not aligned, then they will send the message that maximizes his payoffs.

Gneezy finds that, in the treatment where gains and losses from lying were symmetrical, but small, 36% of senders lied. In the second treatment, where the losses to the receiver from believing a lie greatly exceeded the sender's gain from having a lie believed decreased to rate of lying to 17%. In the third treatment, where the gains and losses to senders and receivers respectively were symmetrical but high, the rate of lying increased to 52%. All of these findings were significant at the 5% level. He concludes, with the aid of an additional dictator game used as a control, that behavior is motivated both by altruism and an aversion to lying. Further, from the questionnaire, Gneezy determines that people believe it is worse to lie as the cost of choosing incorrectly increases for the other side.

Pagés and Vorsatz (2007) aim to show that there exist two conflicting forces in behavior in sender-receiver cheap talk games. Specifically, there is a conflict between incentives and normative social behavior with incentives pushing one to lie and normative social behavior applying pressure in the opposite direction.

They set up two similar games which they call a benchmark game and a punishment game. In the benchmark game, the payoffs are structured such that senders and receivers have opposing preferences. The sender has incentive to lie and the receiver must decide whether or not to trust the message. Complete rationality implies that the only equilibrium is random play, but actually, senders lie significantly less than predicted. The punishment game is set up to show that this

result is due to a preference for truth telling amongst senders.

While, theoretically, senders should lie half the time, they find truth telling happens 55.07% of the time, which is a statistically significant amount of truth telling at the 0.05 level. They further confirm previous studies by showing receivers adjust their behavior toward more believing by acting in accordance with the message 58.7% of the time, a result that is statistically significant at the 0.01 level. In the punishment game, they find first that punishment does occur, and occurs most often, 25% of the time, after receivers trusted a lie. They further find that receivers are more likely to trust a message in the punishment game and that their likelihood of trusting a message increases over time, likely due to public knowledge of the punishment option and the receivers believing that having shown a willingness to punish increases the likelihood that a sender will send a truthful message.

They then divide their data into two groups, those who punish liars frequently after having been deceived, and everyone else. They find that the first group accounts for nearly 90% of all punishments. They call these individuals those with a strong concern for procedural justice. They use this as evidence for, what they call, morally consistent behavior, defined as individuals with a strong notion of procedural justice who behave consistently across roles and are responsible for nearly all the information transmitted by senders. They show that when this cohort is excluded from analysis, the phenomena of excess truth telling disappears. This suggests that personality types could play a significant role if some personality types have a greater aversion to lying, while others have been shown to be linked to

a preference for justice.

Review of relevant risk measurement literature

Holt and Laury (2002) present a menu of paired lottery choices in such a way to elicit a switching point to a high-risk lottery to infer the degree of risk aversion. The menu presents subjects with two lotteries at a time, one safer one riskier. For each lottery, A and B, a probability, p, is given to the better outcome within the lottery. P is then varied as subjects proceed through the experiment, which eventually results in the elicitation of a crossover point. Expected payoff differences between the two lotteries are set up such that the sooner a person switches from lottery A to lottery B is a measure of risk aversion. That is in the initial round, only a person with very little risk aversion will choose lottery B, in the final round only the most risk averse person will choose lottery A, with a linear transition in risk-aversion to lottery choice as rounds progress.

They use treatments of high and low hypothetical and real payoffs and find that a hybrid "power/expo" utility function with increasing relative and decreasing absolute risk aversion replicates their results over a range of payoffs that ranges from several dollars to several hundred dollars. They find, from both of these sources, that subjects typically underestimate the extent to which they will avoid risk, and that risk-aversion, relative and absolute, exists. We deploy an identical decision problem to elicit risk aversion rankings.

Review of relevant Big Five literature, and why personality is relevant to economics

Formal trait theories, which posit that overall personality can be reduced to its fundamental categories, known as traits, first began to emerge in the 1960s (Nettle 2009). While many jostled for dominance, in the early 1990s, the Big Five locus of personality traits was forcefully argued for by Goldberg (1990) in his paper titled "An alternative description of personality: The Big Five structure." While a large number of prominent researchers continue to propound other models, the Big Five locus attained status as the most dominant (Nettle 2009).

Goldberg (1990) counted 1,710 personality describing adjectives and grouped them into 75 clusters. He then used several methods to see which factors would emerge as the best generalizations of these clusters. This model ranked individuals on a scale of one to five on the following five factors: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Goldberg 1990).

He found that the Five Factor model formed the most useful distinctions. Further, these methods showed that other factors were unnecessary in that they either captured too few personality descriptors to warrant a separate category, or they captured too many descriptors to remain useful. All the above methods of calculating factor loadings showed little variation in the outcomes they generated, and were also robust to whether or not trait clustering was done by the subject or by his or her peers. Crucially, these factors had an orthogonal relationship to one another, that is, they represented dimensions, not categories. This implies that not

only are they the best distinctions, there is also little to no overlap between them (Goldberg 1990).

Late in the 1990s, Goldberg spearheaded a project to make the use of trait theories easier than ever. This project was ultimately known as the IPIP, or the International Personality Item Pool. This project is reviewed ten years after its inception by Goldberg et al (2006).

The IPIP placed inventory items into the public sphere of the internet for free. It contains psychometric characteristics of current IPIP scales, keys for scoring set of scales, total set of IPIP items, and a repository for reports of studies conducted using the IPIP. Thus, it provided a one stop shop for items, scales, calculation methods, and potentially useful previously conducted research (Goldberg 2006).

To be sure, it is important to keep in mind that the scales in the IPIP are proxies for scales originally developed for the various personality trait models. As such, the connection between the two may be imperfect. However, reliability measures show that the scales in the IPIP can be more reliable than their parent scales (Goldberg 2006). Thus, we can be reasonably confident in using the IPIP to construct reliable measures of the personality traits we are interested in.

Barrick and Mount (1991) examined the link between the Big Five personality dimensions and job performance. They explore five different occupation groups (professionals, police, managers, sales, and skilled/semi-skilled) for three performance criteria (job proficiency, training proficiency, and personnel data) where performance is defined by salary level, status change, and tenure.

They conduct their analysis first sorted by occupational group, and then by the three criteria. When analyzing by occupational group, they found that conscientiousness was indeed a valid positive predictor for all occupational groupings. They did not find a link between neuroticism and job performance, except for professionals, for whom there is a negative relationship. Finally, they found that extraversion positively predicted success in jobs requiring interpersonal skills, the same did not hold true for agreeableness. When sorting by criteria type, they found that conscientiousness has a positive relationship with performance for all three performance criteria. The hypothesized relationship between openness to experience and job training success was also confirmed. They also found an un-hypothesized link between extraversion and job training success, with no other significant findings.

They use these findings to make a number of interesting suggestions. First, conscientiousness is shown to be a clear predictor of job success in a variety of contexts. As such, they believe it should be incorporated into models that attempt to explain workplace performance. It has been well established that mental ability is a strong predictor of workplace success. Thus, they suggest that this fact along with the fact that conscientiousness and intellect have little correlation implies that conscientiousness may account for the variance in the acquisition of job knowledge and, therefore, in job performance. The link between openness to experience and job training success suggests that openness is measuring an ability to learn as well as a motivation to learn. Finally, to reconcile hypotheses on neuroticism with

findings, they suggest that the relationship between neuroticism and performance of professionals could be a case of reverse causality where the high stress of professional occupations causes individuals to exhibit neurotic traits (Barrick and Mount 1991).

Review of relevant literature that combines economics and personality psychology

Heckman (2011) reviewed the potential problems and benefits of integrating psychology into economics. Personality psychology typically considers a wider array of actions than are typically considered by economists, but personality psychologists lack precise models, whereas economics provides such a framework. Precise models reveal identification problems that plague measurement in psychology research.

Heckman developed a model that defines personality as a response function and the behavior that constitutes personality is defined as a pattern of action in response to constraints, endowments, and incentives facing agents given their goals and preferences. Then actions, not traits, constitute the data used to identify the traits. Enduring actions, then, are the average of the response functions for a person with a given vector of traits. Enduring traits can be defined in a variety of ways, such as averaging over a task variable, situation variable, or both. This provides us with some theoretical underpinning for our goals.

Becker, Deckers, Dohmen, Falk, and Kosse (2012) sought to analyze the extent to which economic preferences and psychological concepts of personality are related. They also investigated whether preference measures or economic

preferences predict life outcomes.

They found little correlation between personality traits and preferences. They also found that both have similar explanatory power when used separately in predicting health, life satisfaction, earnings, unemployment, and education. When life outcomes are regressed on both measurement systems, the explained fraction of variance rises by 60%. They conclude that both measurement systems capture distinct sources of heterogeneity in life outcomes. They further conclude that the two methods of describing behavior are complementary.

Becker et al (2012) measure time preference, risk, positive and negative reciprocity, trust, and altruism using the following experiments, respectively: switching point in preference in lists of choices between amount of money today vs. amount of money tomorrow, switching point in preference lists of choices between lotteries of varying safety, second-mover behavior in the trust game, investment in punishment after defection of opponent in a prisoner's dilemma, first-mover behavior in the trust game, first-mover behavior in a dictator game.

They found the following significant correlations at the 10%, 5%, and 1% levels, denoted by *, **, and *** respectively:

Table 2.1 – Personality/Economic Parameters

	Open	Consc	Extravert	Agreeable	Neurotic
Time	0.0370	0.0057	-0.0084	0.1026**	-0.0518
Risk	-0.0379	-0.0611	0.0762*	0.0202	-0.1201***
+ Reciprocity	0.1724	0.0140	0.0211	0.2042***	0.0361
- Reciprocity	-0.0885*	-0.0393	0.0943*	-0.1451***	-0.0136
Trust	0.1232***	0.1300***	0.0004	0.1665***	-0.0134
Altruism	0.1242**	-0.0979*	0.0249	0.1911***	0.0847*

Overall, they found that the degree of association was low, which suggests a complementary relationship. This suggestion is bolstered by the fact that adjusted R^2 for the connection between health, life satisfaction, earnings, unemployment, and years of education are all better explained by the combination of preferences, Five-Factor, and locus of control in any combination than by themselves. We use this to predict findings in our own analysis.

Lonnqvist, Verkasalo, and Walkowitz (2011) set up the following experiment. A total of 120 participants were divided into groups of 20 and played either an incentivized or hypothetical version of the prisoner's dilemma. After the game, a Big Five personality questionnaire was given. All games were one-shot and all players were matched randomly. Cooperation levels were variable such that several different "levels" of cooperation were available. Participants were given an endowment for which they had the option of sharing with a partner where the amount given would be doubled (we should note that this experiment, though described as a prisoners dilemma, is really a trust game). Along with the Big Five questionnaire, risk attitude was also assessed by survey.

Their results are as follows. The researchers found that age and sex were not significant, and found a series of correlations sorted by hypothetical and incentivized. The hypothetical game showed either no statistically significant personality factors and only had an R^2 of .02. The incentivized game found significant relationships between amount transferred and low neuroticism and openness to experience.

Pothos, Perry, Corr, Matthew, and Busemeyer (2011) set up the following experiment. A total sample size of 113 were partnered up and played a prisoner's dilemma game with instructions to maximize payoff. Payoffs were also in two formats of high and low. Personality was then measured in both BIS (a scale that measures impulsivity), and BAS (a scale that measures likelihood of acting on desires) scales.

The researchers set up half of the games played such that the optimal strategy was to cooperate, and the opposite for the second half. Pothos et al. instructed players to maximize payoffs even though one can easily imagine a scenario where a typically agreeable person would try to put aside a natural inclination to cooperate since they have essentially been told to be focus only on maximizing payoffs.

Their results are as follows. Significant correlations were found for neuroticism and conscientiousness when the optimal strategy was to defect. Significant correlations were found for agreeableness, extraversion, and openness to experience when the optimal decision was to cooperate.

Other papers concerning the relations between measures of personality have found the following. The connection between conscientiousness and the discount rate is mixed with Daly et al. (2009) finding a negative relationship and Dohmen et al. (2010) and Anderson et al. (2011) finding the opposite. Almlund et al. (2011) find time preference is significantly correlated to agreeableness at the 10% level. This finding is corroborated by Anderson et al. (2011), who find a relationship between

delay acceptance and agreeableness. Dohmen et al. (2011) finds a significant relationship between risk preference and openness to experience at the 1% level, and agreeableness at the 5% level. Borghans et al. (2009) found a significant positive relationship between risk aversion and neuroticism. Dohmen et al. (2008) find that trust is positively related to agreeableness and openness to experience, and negatively to conscientiousness and neuroticism. They further find that positive reciprocity is related positively with all five facets, and negative reciprocity is related negatively to conscientiousness and extraversion. Finally, altruism, as measured by the dictator game, is related positively with extraversion by Ben-Ner and Kramer (2010).

CHAPTER THREE

EXPERIMENT DESIGN

In this section, we review the personality questionnaire and each game played. First we describe the general form of the game and personality questionnaires. Next, we describe and provide intuitive rationalizations for our choices of adjustable parameters and questionnaire items. Finally, we review the key decisions made by participants and what we hope to learn from these decisions.

The Trust Game

In the trust game, players are paired, with one player taking the role of sender, and the other player taking the role of receiver. The sender is given some amount of money. The sender then decides how much of this amount, if any, to send to the receiver. If the sender sends nothing, the game ends. If the sender sends any amount, that amount is multiplied by some multiplier, and the new amount is received by the receiver. The receiver must then decide how much of the amount received to send back to the sender. At this point, the game ends, regardless of how much is sent back. The game can be played any number of times, with any number as the multiplier, and with any kind of matching.

For our experiment, we chose to have participants play the game twice, once as the sender and once as the receiver and matching was random both times. The sender is given an endowment of $X. The investor can then invest any portion of this endowment, that is, $x \in [0 : X]$. We let T equal the amount sent so the sender keeps X-T. The amount sent is multiplied by some number, r. The other player receives

this amount (r)(T). The receiver is then permitted to keep any portion of this amount. If we let Y equal the amount kept by the receivers then the total payouts are Y for the receiver and X-Y+rT for the sender. The variables are given the following values: X=$10, r=2. These figures are in experimental dollars, which were converted to real dollars at an exchange rate or 1 ED = $0.25. All of the above information and payouts were made known to participants after each round

The Minimum Effort Game

In the minimum effort game, participants are put into groups and choose effort levels. Their payoff is determined by their own effort selection and the within group minimum effort. Typically, the payoff will be decreasing in own effort, and increasing in the minimum effort. We follow the example of Van Huyck 1990 in most respects. Effort levels are bounded to integers from 1 to 7, inclusive, with 1 representing the lowest possible effort choice, and 7 representing the highest. The payoff function was 50 plus 20 times the minimum effort minus 10 times own effort. Stated precisely, individuals have payoff functions of $\pi_i(e_1,\ldots,e_n) = 50 + 20 * \min\{e_1,\ldots,e_n\} - 10 * e_i$ where π_i is payoff for player I and $i \in \{1,2,3\}$, $e_i \in \{1,2,\ldots,7\}$. The multiplier parameters for the minimum and own effort levels were chosen to create opposing incentives to raise and lower effort levels. The addition of 50 to this payoff function was to eliminate negative payoffs.

Players were randomly matched into groups of 3 and played the game 5 times. After these 5 rounds, players were randomly re-matched into groups of 3 and

played the game 5 more times. Payoffs and the group minimum were revealed after each round.

Group sizes were chosen based on previous evidence showing that group sizes less than 3 tended to lead to convergence to the highest effort levels, while group sizes greater than three tended to lead to convergence to the lowest effort levels. Hence, a group size of 3 provided the greatest amount of variation to explain, wherein group effects were minimized. Participants played the game 5 times due to previous evidence suggesting coordination at an effort level tends to be reached at around this mark. Players were re-matched and played another 5 rounds simply to maximize data output under time constraints. All payoffs were in experimental dollars, which were converted to dollars using an exchange rate of 1 ED = $0.05.

Our first point of interest in this game is whether or not coordination happens. Then we must see if coordination happens, and at what level of effort it occurs. Since a higher effort choice is a risky move, we seek to compare what does a better job of explaining choices, the Big Five locus of personality traits, religiosity, risk aversion, or some combination of these. We then explore how personality traits effect reactions to being the minimum in a given group. We also explore whether or not personality traits impact coordination. Finally, we explore the relationship between personality traits and risk aversion itself to see if a connection can be forged between the two. The aforementioned are also sorted to observe if any effects vary by gender.

The Cheap Talk Game

Cheap talk games are a broad class of economic games. Their distinguishing feature is that one party has access to information that another interested party does not. Further, the information can be passed along by the information carrying party, but there is no way for others to verify this information.

In our experiment, we randomly pair participants, who are then given the role of either sender or receiver. The sender receives information regarding payoffs contained in a decision between two choices, called A and B. The sender then decides on a message to send to the receiver. The first message states, "Prize A earns the Sender more than the Receiver," while the second message states "Prize B earns the Sender more than the Receiver." The payoffs in the two choices are always the inverse of one another, so if one gives the sender X and the receiver Y, the other gives the sender Y and the receiver X. Payoffs ranged between 10 and 100 inclusive, in increments of 10, that is, $\pi_{(S,R)} \in \{10, 20, \ldots, 100\}$. Upon receiving the message, the receiver chooses amongst the options. The game ends once the receiver makes a decision. Payoffs are then revealed and subjects are randomly re-matched and play the game again. All subjects played the game a total of 16 times, alternating between the roles of sender and receiver. All payoffs are in experimental dollars which are converted to real dollars at an exchange rate of 1 ED = \$0.05. This is a game with only mixed strategy equilibria where both senders and receivers randomize truth telling and message believing.

The phenomenon of cheap talk can be explored in a number of ways, and this set up provided us with the simplest context to conduct this exploration. The repeated game allows us to examine the interaction between personality traits and history.

Risk Aversion Assessment

This class of decision problems is typically played to get a pure measure of risk aversion amongst participants. Since we seek to gather as pure a measure of risk aversion as possible for use in analysis of the other games, our setup almost exactly mirrors the Holt and Laury 2002 design and is presented in the following table:

Table 3.1 – Risk Lotteries

Choice	Option A	Option B
1	1/10 of $2.00, 9/10 of $1.60	1/10 of $3.85, 9/10 of $0.10
2	2/10 of $2.00, 8/10 of $1.60	2/10 of $3.85, 8/10 of $0.10
3	3/10 of $2.00, 7/10 of $1.60	3/10 of $3.85, 7/10 of $0.10
4	4/10 of $2.00, 6/10 of $1.60	4/10 of $3.85, 6/10 of $0.10
5	5/10 of $2.00, 5/10 of $1.60	5/10 of $3.85, 5/10 of $0.10
6	6/10 of $2.00, 4/10 of $1.60	6/10 of $3.85, 4/10 of $0.10
7	7/10 of $2.00, 3/10 of $1.60	7/10 of $3.85, 3/10 of $0.10
8	8/10 of $2.00, 2/10 of $1.60	8/10 of $3.85, 2/10 of $0.10
9	9/10 of $2.00, 1/10 of $1.60	9/10 of $3.85, 1/10 of $0.10

Payoffs are in real dollars and are given for 1 of the 9 rounds. The round for which payoff is made is decided randomly by a random number generator prior to the experiment. This information, of course, is not disclosed to participants. Risk aversion is calculated by observing the switching point from gamble B to gamble A.

The Personality Questionnaire

With the Five Factor model, participants answer questions which are used to determine how they rank on a scale from 1 to 5 on 5 different personality traits: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism "(OCEAN)".

Openness to experience is meant to capture whether an individual is inventive or curious versus consistent or cautious, where a low rating implies the latter and a high rating implies the former. Conscientiousness is meant to capture whether a person is efficient and organized versus easy-going and carefree, with a low rating implies the latter and a high ranking implies the former. Extraversion is meant to capture whether a person is solitary and reserved verses outgoing and energetic, with a low rating implying the former and a high rating implying the latter. Agreeableness is meant to capture whether a person is cold and unkind versus friendly and compassionate, with a low rating implying the former and a high rating implying the latter. Neuroticism is meant to capture whether a person is sensitive and nervous versus secure and confident, with a low rating implying the latter and a high rating implying the former.

These factors are assessed using self-reported answers to questions. A large repository of the questions used is the International Personality Item Pool (IPIP). This repository contains a massive number of questions that can be used to elicit rating on the Big Five locus of personality traits, as well as other traits. We selected questions from this database to assess how participants rate on the Big Five, along with religiosity. Prior to playing the games, each participant completed a questionnaire that consisted of a fixed number of randomly selected questions from a subset of the questions available in the IPIP. Specifically, we used ten items for each of the Big Five traits, plus seven additional items for religiosity, for a total of 57 items. At the end of the questionnaire we also requested information regarding gender, race, high school attended, major, and a unique identifying number. Although names were initially collected to aid in ensuring the correct individuals came to the ensuing lab sessions, this information was discarded along with all other identifying information after subjects had their personality and lab data paired

CHAPTER FOUR

METHODS

A total of 84 participants were recruited via word of mouth, e-mails to students who had previously expressed interest in participating in experiments, and announcements in classrooms. All participants were students at Clemson University. Subjects were told said that participation entailed an online questionnaire that took 20 minutes to complete and a one-hour long lab session.

Upon signing up for the experiment, participants were directed to a link to the online survey, administered through Survey Monkey. The survey used items from the IPIP designed to elicit rankings on scales for openness to experience, conscientiousness, extraversion, agreeableness, neuroticism, and religiosity. The questionnaire also gathered the demographic information of gender, race, age, course of study, and region of origin. Participants were assigned to lab sessions of either 12 or 18. Sessions occurred between a day and a week following completion of the questionnaire.

Upon entering the lab, participants were given two sets of instructions, one explaining the general procedure of the experiment and the other explaining how to play the first game. We randomized the order of the games for each lab session. All instructions were read aloud. At the end of each game, participants were given a copy of the instructions for the next game. All the instructions are included in the appendix.

Once all games were completed, participants entered in identification numbers used in online surveys. This was used to connect questionnaire and lab data. Participants were then shown their total earnings. Earnings were then distributed and the lab session was concluded. The minimum payoff was $14.40, the maximum was $25.70, and the mean was $19.80. The games were played on computer terminals and coded in zTree.

CHAPTER FIVE

RESULTS

We begin with baseline results regarding our sample. Next we show results from the questionnaire and look at reliability estimates. This is followed by summary statistics for the risk problem, since that is also a dependent variable. Then, since a number of different games were played, with varying objectives and questions of interest, we break down our review of results by game. First, we will look at results from the Trust Game, then the Minimum Effort Game, and finally, the Cheap Talk game. Where appropriate, we conduct chow tests to see whether sorted analysis is appropriate, though we include results regardless for the sake of consistency in analysis, while noting the results of the chow test in question.

Dependent Variables

Among the 84 subjects, there were 44 men, 36 women, and 4 who did not disclose their gender. 60 participants were Caucasian, 20 were not, and 4 did not disclose their race. The average participant was 20.825 years old. Tables showing results for all specifications for each game are included at the end of the discussions of each game. Standard errors are in parentheses and asterisks are used to indicate degree of significance.

A correlation coefficient table for personality traits is produced below.

Table 5.1.1 – Personality Traits Correlation Coefficients

	Open	Consc	Extravert	Agreeable	Neurotic	Religious
Open	1.0000					
Consc	0.1657	1.0000				
Extravert	0.3642	0.1983	1.0000			
Agreeable	0.2577	0.1158	0.1703	1.0000		
Neurotic	-0.1893	0.1941	0.3573	-0.1668	1.0000	
Religious	0.1685	0.1950	0.1271	0.2293	0.0707	1.0000

A table of estimated internal consistency reliability of the Big Five and religiosity is produced below.

Table 5.1.2 – Internal Consistency of Big Five

	# of Items	*M*	*SD*	Cronbach's Alpha
Neurotic	10	2.549	.693	.828
Extraverst	10	3.587	.676	.867
Open	10	3.743	.463	.667
Agreeablen	10	3.826	.544	.794
Consc	10	3.851	.604	.857
Religious	7	3.811	.996	.903

Cronbach's alpha is a coefficient of reliability. The closer this value is to 1, the more reliable is the measure. As we can see, our measures are fairly reliable, with the mild exception of openness to experience. Further, the means and standard deviations are well within the range of what would be considered typical results.

For the our analysis, unless indicated otherwise, we test models of the Big Five, the Big Five plus religiosity, demographics, the previous three combined, risk aversion, and historical and/or contextual variables, as appropriate. In the interest of consistency and understandability, they are always presented and discussed in this order. The Big Five and religiosity are continuous from 1 to 5. The age variable maps individual aged from 18 through 65 from 1 to 48 in order, with 49 signifying

and age of 66 or higher; Race is categorical where 1 is Caucasian (White), and 0 otherwise; Gender is 1 for female, 2 for male; Risk aversion ranges continuously from 1 to 2. Historical and contextual variables are explained where appropriate.

The Trust Game

Average proportions sent and returned are produced in the table below, with standard deviations below, in parentheses.

Table 5.2.1 – Trust Game Summary

	Proportion Sent	Proportion Returned
Overall	0.4024	0.2389
	(0.3253)	(0.2600)
Men	0.4318	0.1864
	(0.3555)	(0.2475)
Women	0.3416	0.2784
	(0.2623)	(0.2740)

The first decision we need to explain in the trust game is that of the amount sent by the sender to the receiver. In the first model, we see the strongest effects from conscientiousness, agreeableness, and neuroticism. A rise in conscientiousness of 1 reduces amount sent by -0.861, all else constant. Agreeableness has a positive magnitude of 0.984, while neuroticism has a positive magnitude of 0.645, with similar interpretations. However, none of these effects are significant. Adding religiosity does little to change the results. Analyzing demographics shows an insignificant magnitude of 0.928 for gender, and little else of note. Combining these models shows the most pronounced magnitudes for conscientiousness, agreeableness, neuroticism, race and gender. A one unit rise in agreeableness (all

else constant) increases amount sent by 1.251, with similar interpretations for conscientiousness (-0.592), neuroticism (0.941), race (-0.789), and gender (1.568). Of these, agreeableness, neuroticism, and gender achieve significance at the 0.1 level. Risk aversion has an insignificant magnitude of 0.448, but has an R-squared value of 0, and so is excluded from further analysis. We should note that the model of traits and demographics has an R-squared of 0.12, which means only 12% of variation is explained by this model. These results are presented in full in the following table.

Table 5.2.2 – Amount Sent Overall

Dep. Variable = Amount Sent (N=80)					
	Model 1	Model 2	Model 3	Model 4	Model 5
Openness	0.113	0.302		0.059	
	(0.87)	(0.87)		(0.83)	
Consc	-0.861	-0.960		-0.592	
	(0.58)	(0.58)		(0.61)	
Extravert	0.128	0.034		-0.058	
	(0.65)	(0.65)		(0.72)	
Agreeable	0.984	0.855		1.251*	
	(0.64)	(0.68)		(0.70)	
Neurotic	0.645	0.568		0.941*	
	(0.55)	(0.55)		(0.54)	
Religious		0.249		0.312	
		(0.35)		(0.35)	
Age			-0.026	-0.041	
			(0.17)	(0.17)	
White			-0.242	-0.789	
			(0.99)	(1.10)	
Male			0.928	1.568*	
			(0.73)	(0.83)	
Risk Averse					0.448
					(2.12)
Constant	1.023	0.760	2.765*	-3.734	3.540
	(4.62)	(4.62)	(1.50)	(5.20)	(3.13)
R-Sqr	0.068	0.073	0.021	0.120	0.00

* p<0.10, ** p<0.05, *** p<0.01

Next, we conduct the same analysis as above, but sorted by period. This is especially beneficial in our design since all participants who played sender in the first round played receiver in the second, and vice versa. Hence, the cohort analyzed in each period has no overlap. Chow tests showed that analysis by period was warranted for all three models. For the first period, the first model shows notable magnitudes from openness (-0.934), conscientiousness (-1.032), and agreeableness (1.915). Of these, agreeableness achieves significance at the 0.1 level, meaning a one unit rise in agreeableness increases amount sent by 1.915, in the first period, all else constant. Adding religiosity lowers the magnitudes of openness (-0.712), conscientiousness (-1.251), and agreeableness (1.626), with conscientiousness now achieving significance at the 0.1 level. Adding demographics raises the negative impact of openness (-0.805), reduces the negative impact of conscientiousness (-0.879), and raises the positive effect of agreeableness (1.885), with only agreeableness achieving significance at the 0.1 level. Race and gender also show notable effects of -1.067 and 1.633, respectively.

In the second period, the first model shows notable magnitudes from openness (0.997), conscientiousness (-0.845), extraversion (0.873), and neuroticism (1.529), with neuroticism achieving significance at the 0.1 level, implying a one unit rise in neuroticism increases amount sent in the second period by 1.529. Adding religiosity has a small effect on estimates. Adding demographics slightly raises the magnitude for openness (1.007), lowers the magnitude for conscientiousness (-

0.723), raises the magnitude of extraversion (1.455), and raises the magnitude of neuroticism (1.783), with neuroticism achieving significance at the 0.05 level. Agreeableness is notably absent from these results. Further, the effect of neuroticism is felt far more in the second period than in the first. It appears that with no history, agreeableness is the best predictor of amount sent. However, after just one round of play as the receiver, neurotic individuals tend to send more. These results are presented in full in the following table.

Table 5.2.3 – Amount Sent by Period

Dep. Variable = Amount Sent (N=40)						
	Period 1			Period 2		
	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Openness	-0.934	-0.712	-0.805	0.997	0.957	1.007
	(0.97)	(0.95)	(0.93)	(0.93)	(1.01)	(1.12)
Consc	-1.032	-1.251*	-0.879	-0.845	-0.834	-0.723
	(0.72)	(0.69)	(0.80)	(0.91)	(0.98)	(1.13)
Extravert	0.162	0.024	-0.162	0.873	0.892	1.455
	(0.81)	(0.78)	(0.98)	(1.01)	(1.08)	(1.54)
Agreeable	1.915*	1.626	1.885*	0.277	0.294	0.322
	(0.98)	(1.04)	(0.97)	(0.73)	(0.70)	(0.91)
Neurotic	-0.167	-0.320	0.089	1.529*	1.540*	1.783**
	(0.65)	(0.64)	(0.78)	(0.81)	(0.79)	(0.83)
Religious		0.473	0.575		-0.039	0.104
		(0.45)	(0.43)		(0.57)	(0.57)
Age			-0.133			0.225
			(0.22)			(0.27)
White			-1.067			-0.949
			(1.67)			(1.64)
Male			1.663			0.469
			(1.19)			(1.18)
Constant	4.652	4.816	0.694	-5.498	-5.408	-10.313
	(5.86)	(5.65)	(6.17)	(5.80)	(6.07)	(7.88)
R-Sqr	0.159	0.185	0.269	0.140	0.140	0.188

*p<0.10, ** p<0.05, *** p<0.01

Next, we seek to explain the proportion of the amount received that is returned by receivers. The first model shows notable positive magnitudes from neuroticism (0.108) and agreeableness (0.086). These two factors are significant at the 0.1 and 0.05 levels, respectively. Adding religiosity, demographics, or both does little to alter these results. Agreeableness is no longer significant, and neuroticism is the only factor that remains significant throughout and maintains a magnitude of about 0.1, meaning a one unit increase in neuroticism raises the proportion returned by 0.1. These results are reproduced in the table below.

Table 5.2.4 – Proportion Returned Overall

Dep. Variable = Proportion Returned (N=80)				
	Model 12	Model 13	Model 14	Model 15
Openness	-0.018	-0.024		-0.004
	(0.08)	(0.09)		(0.10)
Consc	0.008	0.011		0.017
	(0.06)	(0.06)		(0.06)
Extravert	0.019	0.021		0.031
	(0.05)	(0.06)		(0.06)
Agreeable	0.086*	0.089		0.091
	(0.05)	(0.06)		(0.06)
Neurotic	0.108**	0.111*		0.099*
	(0.05)	(0.06)		(0.05)
Religious		-0.006		-0.004
		(0.04)		(0.04)
Age			0.016	0.020
			(0.02)	(0.02)
White			0.059	0.032
			(0.07)	(0.08)
Male			-0.095	-0.042
			(0.07)	(0.07)
Constant	-0.389	-0.381	0.267*	-0.548
	(0.46)	(0.47)	(0.14)	(0.43)
R-Sqr	0.093	0.094	0.051	0.124

*p<0.10, ** p<0.05, *** p<0.01

Next, we separate our results by period to see if behavior is impacted by different factors with and without history. Chow tests revealed coefficients were different from the overall analysis at the 0.05 level for the personality and personality plus religiosity models, but not for risk aversion. In the first period, the first model shows notable magnitudes from agreeableness (0.125) and neuroticism (0.142), significant at the 0.05 and 0.1 levels, respectively. These magnitudes change little after adding religiosity. Adding demographics strengthens the effect of agreeableness (0.187) and minimally alters the effect of neuroticism (0.148). Both results are significant at the 0.05 level. Further, race is revealed to have a magnitude of 0.245, significant at the 0.1 level. In the second period, however, most of these results disappear. These results are summarized in the table below.

Table 5.2.5 – Proportion Returned by Period

Dep. Variable = Proportion Returned (N=40)						
	Period 1			Period 2		
	Model 17	Model 18	Model 19	Model 21	Model 22	Model 23
Openness	0.053	0.017	0.045	-0.094	-0.064	-0.041
	(0.08)	(0.12)	(0.12)	(0.15)	(0.15)	(0.17)
Consc	-0.086	-0.077	-0.082	0.095	0.047	0.020
	(0.10)	(0.10)	(0.08)	(0.09)	(0.09)	(0.08)
Extravert	0.013	0.030	-0.001	0.021	0.005	0.017
	(0.12)	(0.13)	(0.14)	(0.06)	(0.05)	(0.05)
Agreeable	0.125**	0.137**	0.187**	0.012	-0.045	-0.093
	(0.06)	(0.06)	(0.09)	(0.08)	(0.08)	(0.11)
Neurotic	0.142*	0.152**	0.148**	0.042	-0.011	-0.001
	(0.08)	(0.07)	(0.07)	(0.05)	(0.05)	(0.07)
Religious		-0.030	-0.032		0.076*	0.081*
		(0.06)	(0.06)		(0.04)	(0.04)
Age			0.043*			-0.018
			(0.03)			(0.03)
White			0.245*			-0.026
			(0.13)			(0.10)
Male			0.008			-0.056
			(0.09)			(0.09)
Constant	-0.483	-0.405	-0.925	-0.052	0.123	0.403
	(0.51)	(0.59)	(0.56)	(0.79)	(0.74)	(0.65)
R-Sqr	0.190	0.197	0.317	0.100	0.172	0.197

* p<0.10, ** p<0.05, *** p<0.01

In summary, exploring results by period appears to be the best way to explore behavior in the trust game. For both decisions, we saw that explaining behavior was easier when sorting results by period. For the amount sent decision, in the first period, the most notable predictor was agreeableness, which had a positive effect. In the second period, however, the effect of agreeableness was smaller, while the effects of extraversion and neuroticism became more pronounced, neuroticism significantly so. Gender also had an effect with men typically sending more than women.

For proportion returned, we noticed that the strongest influence of personality traits was in the first period from agreeableness and neuroticism, both in the positive direction. Race also seemed to play a role with Caucasians sending more than non-Caucasians. In the second period, however, most of these effects were washed away. Thus, we see that personality traits do have a role to play in the trust game, but their impact is itself impacted significantly by history.

The Minimum Effort Game

We first produce summary statistics for effort choice, minimum effort, maximum effort, and effort adjustment. These are first produced for the aggregate, then broken down by first period, last period before re-matching, first period after re-matching, and last period overall. They show an overall average effort of about 4. Further, they show that effort levels decreased over time, increased after the re-match, and then decreased again. This information is presented in the tables below, followed by a graphical representation of effort levels by period.

Table 5.3.1 – Minimum Effort Overall Summary

	Mean	Std. Deviation
Effort	3.9488	2.0014
Min Effort	2.9357	1.8263
Median	4	-
Max Effort	5.0071	1.7879
Effort Adjust	-0.1045	1.7471

Table 5.3.2 – Minimum Effort First Period Summary

	Mean	Std. Deviation
Effort	4.4404	1.8059
Min Effort	3.0714	1.4208
Max Effort	5.7857	1.3539
Median	4	-
Effort Adjust	-	-

Table 5.3.3 – Minimum Effort Last Period Before Re-Matching Summary

	Mean	Std. Deviation
Effort	3.8571	2.1740
Min Effort	2.8928	2.0359
Max Effort	4.8928	1.9636
Median	4	-
Effort Adjust	-0.1071	1.8433

Table 5.3.4 – Minimum Effort First Period After Re-Matching Summary

	Mean	Std. Deviation
Effort	4.4881	1.8852
Min Effort	2.8214	1.4982
Max Effort	5.9285	1.1697
Median	5	-
Effort Adjust	0.6309	2.4087

Table 5.3.5 – Minimum Effort Last Period Summary

	Mean	Std. Deviation
Effort	3.5000	2.2628
Min Effort	2.5714	2.0375
Max Effort	4.5714	2.3039
Median	3	-
Effort Adjust	0.0357	1.3660

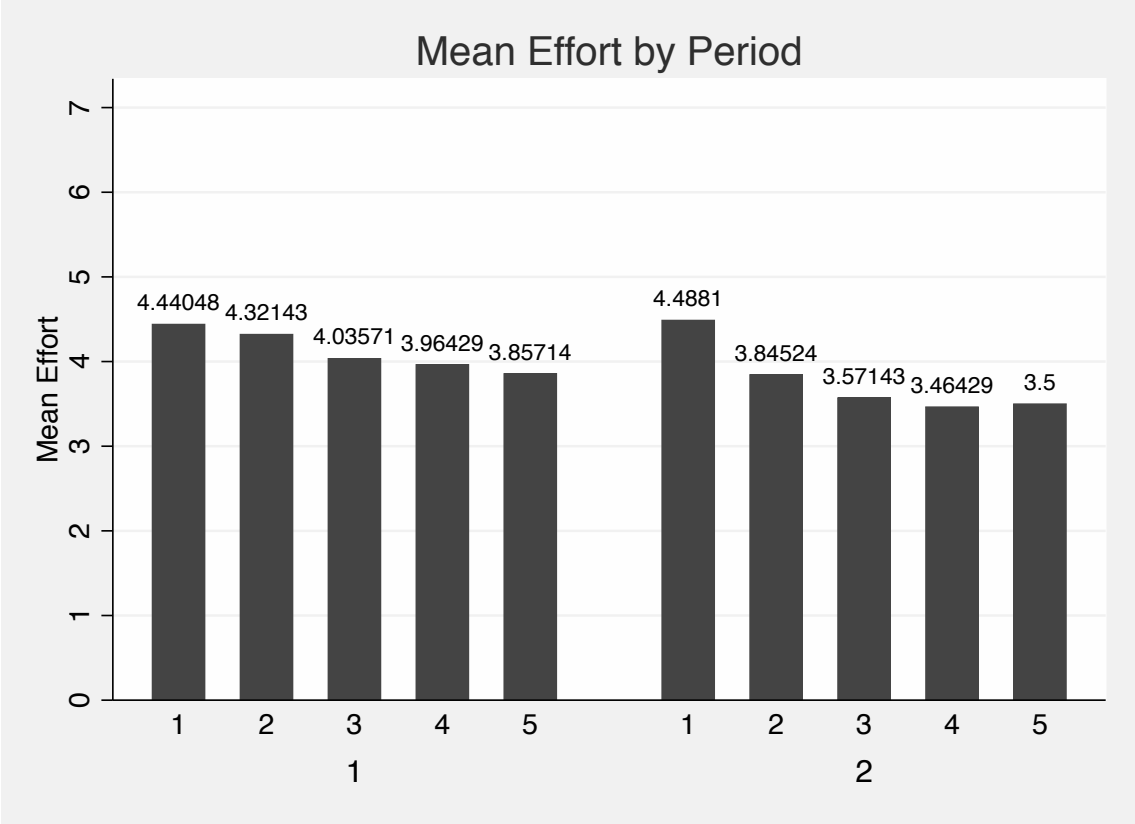


Figure 5.3.1

The most important variable to explain in the minimum effort game is the chosen effort level. In the first model, we see notable magnitudes from openness (-0.499) and conscientiousness (-0.349). However, this model has an r-squared of only 0.03, meaning it explains very little variation in the data. This holds after adding religiosity and demographics, with the only caveat of being male increasing effort by 0.396 (though this result is insignificant). However, when we predict effort with the historical variables of previous effort chosen and the within group minimum effort from the previous round our r-squared jumps to 0.509. The previous effort choice has a magnitude of 0.336, and the previous minimum has a magnitude of 0.519, implying that a one point rise in the previous within group minimum effort choice raises the next effort choice by 0.519, all else constant. Curiously, with one or two exceptions, estimates for variables in all other specifications are negative, with large constants. These results are summarized in the table below.

Table 5.3.6 – Effort Choices Overall

Dep. Variable = Effort (N=800)						
	Model 25	Model 26	Model 27	Model 28	Model 29	Model 30
Openness	-0.499	-0.486		-0.526		
	(0.38)	(0.35)		(0.36)		
Consc	-0.349	-0.355		-0.271		
	(0.29)	(0.30)		(0.31)		
Extravert	-0.095	-0.102		-0.185		
	(0.29)	(0.28)		(0.28)		
Agreeable	-0.038	-0.047		0.029		
	(0.33)	(0.35)		(0.36)		
Neurotic	-0.243	-0.248		-0.186		
	(0.27)	(0.29)		(0.32)		
Religious		0.017		0.033		
		(0.17)		(0.18)		
Age			0.004	-0.028		
			(0.09)	(0.10)		
White			-0.079	-0.019		
			(0.45)	(0.49)		
Male			0.396	0.389		
			(0.32)	(0.37)		
Pre Effort					0.336***	
					(0.05)	
Pre Effort Min					0.519***	
					(0.05)	
Risk Averse						0.211
						(0.67)
Constant	8.257***	8.239***	3.374***	7.388***	1.025***	3.633***
	(2.42)	(2.37)	(0.82)	(2.70)	(0.14)	(1.02)
R-Sqr	0.030	0.030	0.009	0.038	0.509	0.000

* p<0.10, ** p<0.05, *** p<0.01

Next, we conduct the same analysis, but isolate the results from the first round of play. Chow tests showed that analysis by period was warranted for personality plus religiosity and risk aversion, but not for personality, demographics alone, or personality plus religiosity and demographics. This analysis reveals few personality magnitudes of note. Most notable is the effect of openness, which has a

magnitude of -0.690 in the model with personality and demographics, though this result is insignificant. The most pronounced effect seems to be that of being male. This magnitude hovers around 0.89 and is significant at he 0.05 and 0.1 levels in the demographic and demographic plus traits models, respectively. This implies that being male suggests about a 0.89 larger effort choice in the first round than being female. A final estimate of note is risk aversion which has a magnitude of 1.247, implying that a shift most risk averse to least risk averse raises effort choice by 1.247. However, this result is insignificant. This suggests that being less risk averse positively predicts effort levels in the first round, but that this effect shows volatility across subjects. These results are summarized in the table below.

Table 5.3.7 – Effort Choices First Round

Dep. Variable = Effort (First Round) (N=80)					
	Model 31	Model 32	Model 33	Model 34	Model 35
Openness	-0.404	-0.654		-0.690	
	(0.47)	(0.48)		(0.44)	
Consc	-0.474	-0.342		-0.090	
	(0.39)	(0.40)		(0.42)	
Extravert	0.089	0.214		-0.072	
	(0.39)	(0.36)		(0.38)	
Agreeable	0.040	0.211		0.410	
	(0.37)	(0.39)		(0.36)	
Neurotic	-0.248	-0.147		-0.097	
	(0.35)	(0.35)		(0.38)	
Religious		-0.330		-0.291	
		(0.20)		(0.20)	
Age			0.016	0.004	
			(0.09)	(0.10)	
White			0.379	0.455	
			(0.54)	(0.58)	
Male			0.886**	0.903*	
			(0.40)	(0.52)	
Risk Averse					1.247
					(0.94)
Constant	7.884***	8.232***	2.666***	5.635*	2.574*
	(2.74)	(2.62)	(0.91)	(3.18)	(1.45)
R-Sqr	0.036	0.063	0.072	0.122	0.019

* p<0.10, ** p<0.05, *** p<0.01

Next, we conduct the same analysis on the first round after subjects have been re-matched. Chow tests showed that analysis by period was warranted for all of the tested models. Here, we find no effects significantly different from zero from personality traits, religiosity, demographics, or risk aversion. There are notable negative effects from conscientiousness (approx.. -0.5) and neuroticism (approx. -0.45), though these are also insignificant. The effect from previous effort chosen and previous minimum is significantly positive at the 0.1 level, but is much smaller in

magnitude in comparison to the overall results. The effect of risk aversion maintains its relative magnitude and volatility. This suggests that participants do re-strategize in some fashion after they have been re-matched, though we cannot comment on whether or not this strategy is anything other than an arbitrary effort selection. These results are summarized in the table below.

Table 5.3.8 – Effort Choices in First Round after Re-Matching

Dep. Variable = Effort (First Round after Re-matching) (N=80)						
	Model 36	Model 37	Model 38	Model 39	Model 40	Model 41
Openness	-0.074	-0.058		-0.009		
	(0.48)	(0.47)		(0.47)		
Consc	-0.601	-0.609		-0.492		
	(0.40)	(0.42)		(0.45)		
Extravert	0.016	0.008		-0.300		
	(0.40)	(0.41)		(0.43)		
Agreeable	-0.047	-0.058		-0.013		
	(0.42)	(0.47)		(0.44)		
Neurotic	-0.409	-0.416		-0.493		
	(0.38)	(0.40)		(0.42)		
Religious		0.021		0.041		
		(0.23)		(0.23)		
Age			-0.004	-0.019		
			(0.10)	(0.10)		
White			0.546	0.789		
			(0.55)	(0.56)		
Male			0.624	0.421		
			(0.42)	(0.52)		
Pre Effort					0.234**	
					(0.09)	
Pre Effort Min					0.244**	
					(0.11)	
Risk Averse						0.724
						(0.85)
Constant	8.191**	8.168**	3.079***	7.401**	2.969***	3.404**
	(3.21)	(3.16)	(0.95)	(3.54)	(0.46)	(1.30)
R-Sqr	0.044	0.044	0.047	0.084	0.152	0.006

* p<0.10, ** p<0.05, *** p<0.01

Next, we look to see if we can explain coordination within group, where coordination is defined as whether or not members in a group converge to the same effort levels. To explore this, we construct a variable that measures the standard deviation of effort levels chosen within groups. We then make this the dependent variable in regressions, using the same independent variables as before.

Personality traits, religiosity, demographics, and risk aversion once again have a difficult time explaining much as no parameter in any model differs significantly from zero. Further, the magnitudes of all of these parameters remain quite small, with the exception of risk aversion, for which a shift from most risk averse to least risk averse decreases coordination by 0.245. This effect too, however, maintains the previously seen volatility in the effect of risk aversion as it has a large standard error. When previous effort chosen appears to have little to no effect on coordination. The only variable that significantly affects coordination is the minimum effort for a group in the previous round, which has a magnitude of -0.189. This implies a one point rise in the previous minimum effort decreases the within group standard deviation (increases coordination) by 0.189. No r-squared is greater than 0.051, meaning even our best model can only explain about 5% of the variation in coordination behavior. These results are summarized in the table below.

Table 5.3.9 - Coordination

Dep. Variable = Within Group Standard Deviation (N=800)						
	Model 42	Model 43	Model 44	Model 45	Model 46	Model 47
Openness	-0.090	-0.053		-0.076		
	(0.16)	(0.15)		(0.16)		
Consc	-0.001	-0.020		-0.025		
	(0.12)	(0.12)		(0.13)		
Extravert	0.022	0.004		0.077		
	(0.11)	(0.11)		(0.11)		
Agreeable	0.013	-0.012		0.003		
	(0.15)	(0.16)		(0.17)		
Neurotic	-0.072	-0.087		-0.052		
	(0.12)	(0.12)		(0.13)		
Religious		0.049		0.047		
		(0.07)		(0.07)		
Age			0.005	0.011		
			(0.04)	(0.05)		
White			-0.197	-0.225		
			(0.16)	(0.18)		
Male			-0.013	-0.024		
			(0.14)	(0.15)		
Pre Effort					0.060*	
					(0.03)	
Pre Effort Min					-0.189***	
					(0.04)	
Risk Averse						0.245
						(0.28)
Constant	1.960*	1.909*	1.729***	1.783	1.832***	1.206***
	(1.05)	(1.01)	(0.32)	(1.14)	(0.15)	(0.42)
R-Sqr	0.002	0.003	0.005	0.009	0.051	0.002

* p<0.10, ** p<0.05, *** p<0.01

Next, we investigate how effort levels are adjusted in reaction to learning about the efforts chosen. Specifically, first we set effort change as the dependent variable while isolating results from subjects finding out that their effort was the minimum effort in their group, and then redo the analysis for the converse.

When subjects are the minimum, we find that personality, religiosity, and demographics cannot predict effort adjustment in that no r-squared exceeds 0.011.

Further, no effects differ significantly from 0. The only magnitude of some note is that of neuroticism (approx.. 0.14), which tends to raise effort levels slightly when subjects find out they are the minimum We find a small but positive effect from the previous minimum, significant at the 0.01 level, though this is not particularly enlightening. Risk aversion shows a large negative, but insignificant, effect (-0.582) with the same large standard error we have seen in previous results. Overall, none of the models explored have much explanatory power. Chow tests were cleared for all tested models. These results are summarized in the table below.

Table 5.3.10 – Reaction to Being Minimum

Dep. Variable = Effort Adjustment (If Minimum) (N=402)						
	Model 48	Model 49	Model 50	Model 51	Model 52	Model 53
Openness	0.131	0.101		0.058		
	(0.25)	(0.25)		(0.24)		
Consc	0.064	0.072		0.079		
	(0.13)	(0.13)		(0.15)		
Extravert	-0.124	-0.112		-0.035		
	(0.13)	(0.13)		(0.14)		
Agreeable	0.019	0.031		0.063		
	(0.18)	(0.18)		(0.20)		
Neurotic	0.114	0.124		0.168		
	(0.13)	(0.14)		(0.15)		
Religious		-0.029		-0.039		
		(0.07)		(0.07)		
Age			0.034	0.032		
			(0.04)	(0.04)		
White			-0.135	-0.175		
			(0.18)	(0.19)		
Male			-0.084	0.018		
			(0.17)	(0.21)		
Pre Effort Min					0.141***	
					(0.03)	
Risk Averse						-0.582
						(0.49)
Constant	-1.323	-1.248	-0.577*	-1.600	-1.114***	0.192
	(1.21)	(1.22)	(0.35)	(1.58)	(0.15)	(0.72)
R-sqr	0.007	0.007	0.005	0.011	0.031	0.005

* p<0.10, ** p<0.05, *** p<0.01

Looking at reactions to not being the minimum, we found that agreeableness has a significant negative effect on effort level adjustments. That is, a one unit increase in agreeableness leads to a roughly -0.4 revision in effort levels when another member of their group was the minimum. This effect was greatest when including the Big Five and religiosity. Aside from this, the only other notable result was that risk aversion maintains its volatile effect on decision making. No other

effects differ significantly from zero. These results are summarized in the table below.

Table 5.3.11 – Reaction to Not Being Minimum

Dep. Variable = Effort Adjustment (If Not Minimum) (N=318)						
	Model 54	Model 55	Model 56	Model 57	Model 58	Model 59
Openness	-0.105	-0.073		-0.113		
	(0.20)	(0.20)		(0.21)		
Consc	0.183	0.143		0.153		
	(0.12)	(0.12)		(0.14)		
Extravert	0.095	0.074		-0.005		
	(0.13)	(0.12)		(0.14)		
Agreeable	-0.357**	-0.412***		-0.412**		
	(0.14)	(0.15)		(0.16)		
Neurotic	-0.050	-0.074		-0.069		
	(0.12)	(0.12)		(0.13)		
Religious		0.077		0.089		
		(0.08)		(0.08)		
Age			-0.014	-0.031		
			(0.03)	(0.03)		
White			0.118	0.116		
			(0.18)	(0.19)		
Male			0.189	0.202		
			(0.16)	(0.16)		
Pre Effort Min					0.011	
					(0.05)	
Risk Aversion						0.319
						(0.36)
Constant	1.469	1.555	0.314	1.612	0.575***	0.130
	(0.99)	(0.98)	(0.27)	(1.24)	(0.17)	(0.52)
R-sqr	0.014	0.016	0.005	0.022	0.000	0.002

* p<0.10, ** p<0.05, *** p<0.01

We explore two final models to explain effort levels in which we incorporate fixed effects from groups. These models show no effect from personality traits, but find a small positive effect from the minimum in the previous round, significant at the 0.01 level. Most notably, our r-squared values are much higher, meaning fixed

group effects account for a large portion of the variation. These results are summarized in the table below.

Table 5.3.12 – Effort Choices with Fixed Group Effects

Dep. Variable = Effort (N=800)		
	Model 60	Model 61
Openness	-0.156	-0.162
	(0.14)	(0.13)
Consc	-0.140	-0.117
	(0.13)	(0.11)
Extravert	-0.108	-0.111
	(0.15)	(0.15)
Agreeable	0.137	0.127
	(0.10)	(0.09)
Neurotic	-0.129	-0.137
	(0.12)	(0.11)
Previous Min		0.284***
		(0.08)
Constant	7.136***	5.766***
	(0.84)	(0.90)
R-sqr	0.523	0.574

* p<0.10, ** p<0.05, *** p<0.01

In summary, we find the best predictors of behavior in the minimum effort game are the previous effort chosen by the subject, the minimum effort of the group, and fixed group effects. We find that personality, demographics, religiosity play a relatively minor role in determining effort level selections. When we looked at the first period to eliminate the effects of history, we found that notable effects openness, agreeableness, gender, and risk aversion, though only gender achieves significance. After re-matching, we saw notable effects from conscientiousness, neuroticism, and gender, but none of these achieve significance. Indeed the only variables that are consistent predictors are historical parameters. We also saw that

while re-matching does appear to lead to a re-assessment of strategy, this re-assessment may be nothing more than a randomization. We found little evidence of any tested parameter's influence on coordination, with the exception of previous minimum, though even this effect is small. One area where personality traits make a clear impact is with agreeableness, which appears to lead to significant downward effort level revisions when a subject finds out they were not the minimum effort.

The Cheap Talk Game

In this game, the truth was told 61% of the time, and the message was believed 60% of the time. In instances where the sender lied, the receiver believed the lie 62.5% of the time. These results are presented graphically below.

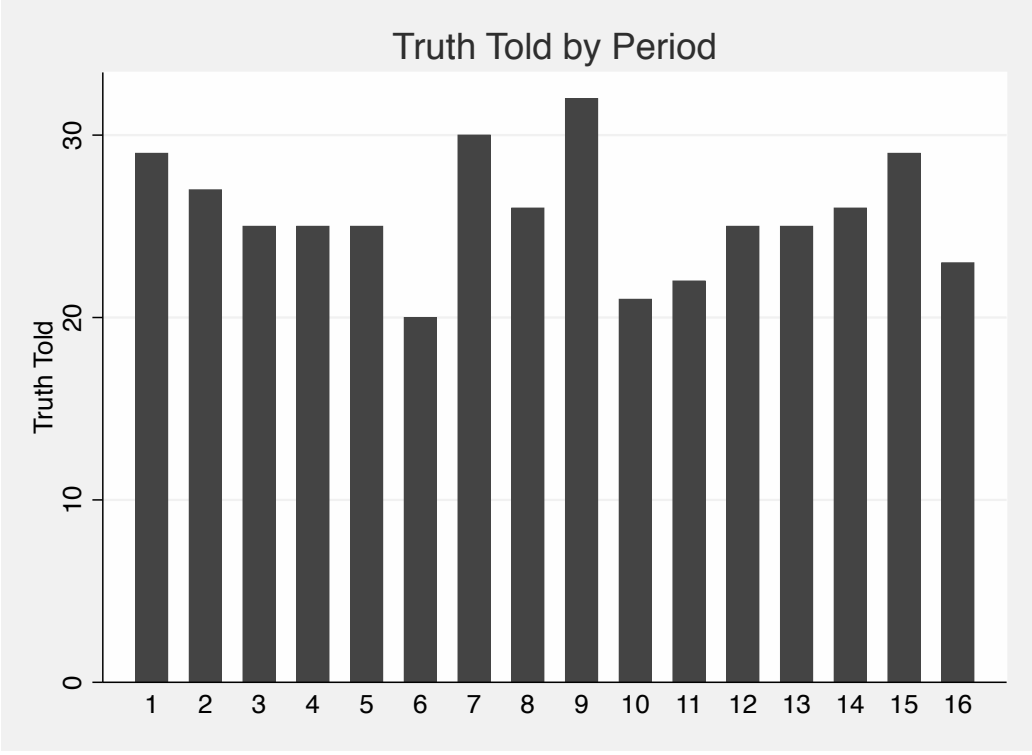


Figure 5.4.1

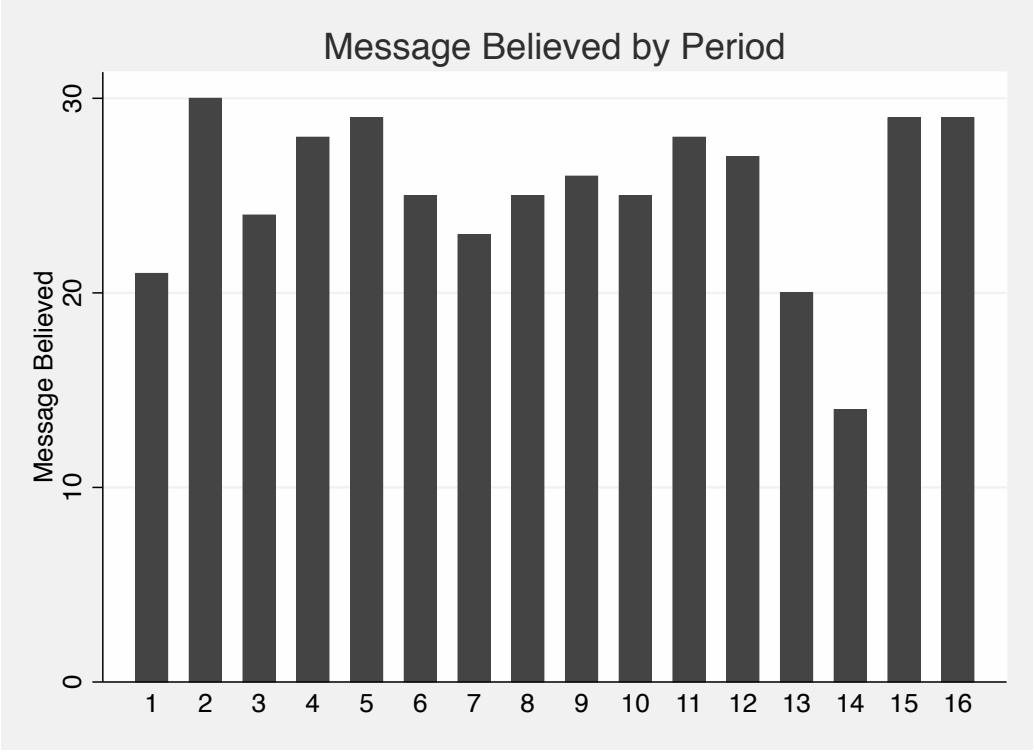


Figure 5.4.2

First, we sought to explain truth telling behavior. There appears to be little influence from the Big Five, religiosity, contextual variables, or risk aversion with truth telling behavior. By contextual variable, we mean the incentives there were to lie, which emerged from the relative size of the prizes. The only small exception was that extraversion has a magnitude of -0.099, meaning a one unit rise in extraversion leads to about a 10% increase in the likelihood of truth telling when demographics are controlled for. This result was significant at the 0.05 level. Race also played a significant role in that Caucasians were about 11% more likely to tell the truth.

The greatest impact appears to be from history. We constructed a variable that measured the percentage of times a participant was lied to over the course of the experiment. Curiously, we found that an additional instance of having been lied

to increases the likelihood of truth telling by about 24%. These results are summarized in the table below.

Table 5.4.1 – Truth Telling

Dep. Variable = Truth Told (N=640)						
	Model 62	Model 63	Model 64	Model 65	Model 66	Model 67
Openness	-0.006	0.029		0.033		
	(0.07)	(0.08)		(0.07)		
Consc	-0.051	-0.069		-0.044		
	(0.04)	(0.04)		(0.05)		
Extravert	-0.030	-0.048		-0.099**		
	(0.04)	(0.04)		(0.05)		
Agreeable	0.061	0.037		0.049		
	(0.05)	(0.05)		(0.04)		
Neurotic	0.061	0.047		0.041		
	(0.04)	(0.04)		(0.05)		
Religious		0.047*		0.052**		
		(0.03)		(0.02)		
Age			0.001	-0.004		
			(0.01)	(0.01)		
White			0.114*	0.111*		
			(0.06)	(0.06)		
Male			0.034	0.095		
			(0.06)	(0.06)		
Lied To					0.237***	
					(0.07)	
Incentive					-0.002**	
					(0.00)	
Risk Averse						-0.056
						(0.12)
Constant	0.555*	0.507	0.461***	0.309	0.597***	0.694***
	(0.33)	(0.33)	(0.12)	(0.36)	(0.06)	(0.19)
R-sqr	0.019	0.027	0.011	0.045	0.030	0.001

* p<0.10, ** p<0.05, *** p<0.01

We use the same models to predict whether or not participants were more likely to believe the message, though we exclude incentives since receivers are not aware of the relative size of the prizes. As such, this information cannot influence their decision making. Analysis reveals little to no impact from personality traits,

religiosity, or risk aversion. In the model that looks only at demographics, females are about 10% less likely to believe the message. The strongest predictor of behavior was, again, how often a subject was lied to. This relationship had a magnitude of -0.190, implying an additional instance of being lied to reduces the likelihood of believing the message by 19%. This result was significant at the 0.05 level. Risk aversion also has a magnitude of note (-0.147), though this result is insignificant. These results are summarized in the table below.

Table 5.4.2 – Message Believing

Dep. Variable = Message Believed (N=640)						
	Model 68	Model 69	Model 70	Model 71	Model 72	Model 73
Openness	0.054	0.060		0.078		
	(0.07)	(0.07)		(0.07)		
Consc	0.023	0.019		-0.010		
	(0.04)	(0.05)		(0.05)		
Extravert	-0.050	-0.054		-0.055		
	(0.04)	(0.05)		(0.06)		
Agreeable	0.047	0.043		0.011		
	(0.05)	(0.05)		(0.06)		
Neurotic	-0.005	-0.008		-0.035		
	(0.05)	(0.05)		(0.05)		
Religious		0.009		0.005		
		(0.03)		(0.03)		
Age			-0.006	-0.004		
			(0.01)	(0.01)		
White			0.027	0.064		
			(0.05)	(0.07)		
Male			-0.103**	-0.105*		
			(0.05)	(0.06)		
Lied To					-0.190**	
					(0.09)	
Risk Averse						-0.147
						(0.12)
Constant	0.324	0.315	0.758***	0.695*	0.672***	0.820***
	(0.36)	(0.36)	(0.10)	(0.39)	(0.04)	(0.18)
R-sqr	0.009	0.009	0.012	0.019	0.013	0.004

*p<0.10, ** p<0.05, *** p<0.01

Finally, we noticed that a significant cohort told the truth every time. This led us to investigate if personality and religiosity were associated with those who told the truth (Model 75) or those who did not (Model 74). Unfortunately, we found that personality and religiosity was not associated with those who told the truth every time, with no magnitude exceeding 0.05. However, we found a significant positive association between religiosity and truth telling amongst those who did not tell the truth each time, though this effect was small in that a one unit increase in religiosity increased the likelihood of being an individual who told the truth each time by 4.4%. These results are summarized in the table below.

Table 5.4.3 – Truth Telling with Exclusions

	Dep. Variable = Truth Told	
	Model 74 (N=172)	Model 75 (N=542)
Openness	-0.009	0.044
	(0.08)	(0.04)
Consc	-0.056	-0.040
	(0.04)	(0.03)
Extravert	-0.005	-0.022
	(0.04)	(0.02)
Agreeable	0.045	-0.002
	(0.04)	(0.03)
Neurotic	0.014	0.024
	(0.04)	(0.03)
Religious	0.009	0.044***
	(0.03)	(0.01)
Constant	0.573*	0.752***
	(0.31)	(0.23)
R-sqr	0.006	0.026

*p<0.10, ** p<0.05, *** p<0.01

In summary, the behavior in the cheap talk game is largely explained by history, with little influence from personality, religiosity, or risk aversion. There

does appear to be signs of an influence from gender as well, and perhaps some from extraversion. Specifically, having been lied to appears to be the most important predictor of both truth telling and message believing, though even this effect was quite small.

CHAPTER SIX

DISCUSSION

In the final section, we combine the results from our experiment with previously existing work to see how our work expands upon this, and what guidance it has for future research on this topic.

Our results for the trust game showed some evidence of effects from some personality traits, demographics, contexts and risk aversion, particularly from agreeableness and neuroticism. These results presented themselves most clearly after sorting by period. Some effects from personality that were present in the first round tended to disappear in the second, with new effects emerging in the second, though to a slightly lesser extent. In the minimum effort game, we again saw some influence from personality traits and demographics, but the best predictors of behavior were past behavior by the individual subject, the past behavior within the group, and fixed group effects. We have similar findings regarding history in the cheap talk game. Risk aversion, which was predicted to have an effect in all three games, showed mixed magnitudes with few instances of significant effects. Thus, our main conclusion from this thesis is that while personality traits and other characteristics do matter to some extent, most of this is quickly washed away once history develops.

In the literature review, we saw that we chose our contextual variables based on those that allowed for the greatest amount of variation in behavior. It was in this setting that we expected to find the greatest influence from personality traits.

Hence, we already knew, and learned further from our experiment, that context is critical in predicting behavior in these games. For instance, in the minimum effort game, we know that when group size is below two, coordination happens at the highest effort level quite often. When the group size is greater than 3, we tend to see convergence to the lowest effort level. Similar examples hold for contextual variables in the trust game (the size of the multiplier, among others) and the cheap talk game (the size of the prize, among others).

Our results, then, suggest several possibilities. One is that our data set simply too small to properly evaluate the phenomenon we wished to explore. Indeed, we did find reasonably sized magnitudes in many cases, with some significant effects. Further, previous literature does suggest that personality traits do have a role to play in explaining behavior in these games. It may also be the case that either the subjects did not fully understand the games, or that our conversion rate of experiment dollars to real dollars was too small to elicit motivated behavior from participants. It could also be the case that we simply missed some important variables in our analysis. We must also consider that the Big Five is one personality trait theory amongst many, so it could very well be the case that a different model will deliver better results.

In terms of creating a coherent model for behavior, one possibility is that economic parameters and trait theories are complementary and can bolster one another's explanations. This is an appealing conclusion, though it could be argued that it is an incoherent story, in that it does have a coherent theory of the mind

underpinning it. If profit maximization and personality trait theories are substitutes, then this calls for a hearty debate between economists and personality psychologists.

Another possibility is that economists have constructed models to explain behavior in the settings they use to explore behavior, while psychologists have constructed models for theirs. This is troubling because if academics are crafting models that only work in contexts they have constructed, they may have nothing to do reality at all and may simply be artifacts of the conditions those groups of academics have respectively constructed.

A final potential conclusion could be that human behavior is highly adaptable and very context-specific. Indeed, perhaps the defining trait of humanity is the variety of situations we encounter and thrive in. It could simply be the case that the foundation of human behavior is that it is adaptable and changeable. This could mean that the pursuit of a single model for human behavior is an insurmountable task. To be sure, this is not to suggest that the study of the drivers of behavior is a pointless one. In fact, what it really implies is that there is a need for a huge sum of research that evaluates the many different contexts and situations in which humans interact. Indeed, if there is one thing this thesis suggests, it is that context and history are crucial in determining behavior.

From a theoretical standpoint, our research suggests, first, that exploring phenomena in repeated games will be dictated primarily by context and history. As such, any future researcher would be well advised to place their focus on these

variables for study. Further, our results suggest that those who wish to focus on the effects of personality should construct games that are either not repeated, change their contextual variables often, or avoid the establishment of history. Practically, our research suggests that those who wish to explore the relationship between personality and behavior in a setting should attempt to control for environment and history before seeking out the impact of personality traits.

Our research, then, is inconclusive. Even our broad approach captures a miniscule sum of the possible contexts and forms of exploration required. An ideal project with no limitations would study far more subjects from many different geographical, historical, and demographical characteristics, under many more contexts, with far more tools of evaluation. The duty for future research is clear.

APPENDIX A

EXPERIMENT INSTRUCTIONS

Hello, everyone. Thank you for coming. Please put your cell phones on silent and please do not communicate with any fellow participants for the duration of the experiment. You should have completed an on-line questionnaire prior to this session. If you have not done so, please come see me once I finish reading the instructions.

Today you will be playing four different games. In the course of the experiment, you will make decisions that will earn you experimental dollars, unless otherwise stated. These experimental dollars will be converted to regular dollars at the end of the experiment at an exchange rate that varies from game to game, so more experimental dollars means more real dollars. All decisions will be clearly explained and your choices are yours alone to make.

The experiment will be conducted on your computer terminals. You will play the games by interacting with a series of prompts on the screen. The choices available to you as well as results and payoffs will be displayed on the screen. Take particular note of the upper right hand corner of the screen. Anytime the program requires an action from you, there will be a clock in this location displaying how much time you have left to act.

If you any questions so far, you may ask them now. If not we can begin the first game.

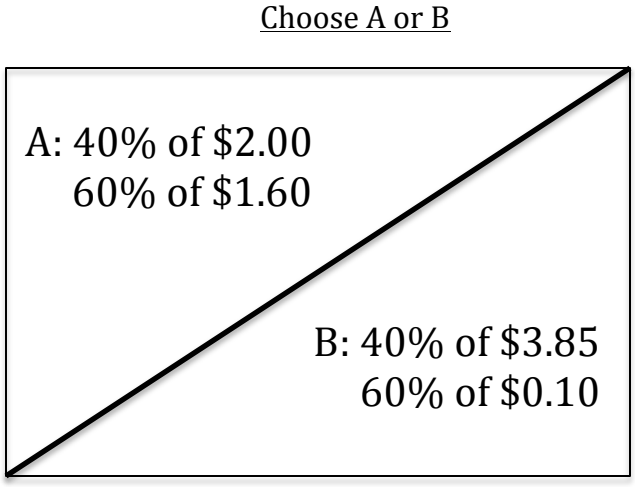
Game 1

In this game, you will be presented with a series of choices, from which you will choose based on your preference. There will be two options, A and B. Option A will present you with a gamble which will give you a certain probability of earning one payoff and one minus that probability for earning an alternate payoff. Option B will provide you with a similar gamble. You will then choose either option A or B depending on which gamble you prefer. Once you make your choice, you will be shown the outcome of the gamble you selected and how much your payoff is accordingly. You will then play the game again 9 more times. The values from the payoffs will be converted into real dollars for one of the ten rounds. The decision regarding which of the ten gambles is used for actual payoffs will be decided randomly. This means at the conclusion of all ten rounds, we will randomly choose one of the rounds to use for your actual payment.

Let's look at an example. Suppose you begin the game and you are presented with two options. Option A says there is a 40% of earning $2.00 and a 60% chance of earning $1.60. Option B says there is a 40% chance of earning $3.85 and a 60% chance of earning $0.10. It is now up to you to decide which of these gambles you prefer. Suppose you choose option B. If you win the gamble, you would earn $3.85. If you lose the gamble, you earn only $0.10.

As you play the game, the values of the probabilities will change, but the payoffs will remain the same. That is, while the amount you can earn from each gamble stays the same, the chances of you winning and losing a gamble will change. This may change whether you prefer option A or B, so keep a close watch on those probabilities!

If you have any questions, you may ask them now.



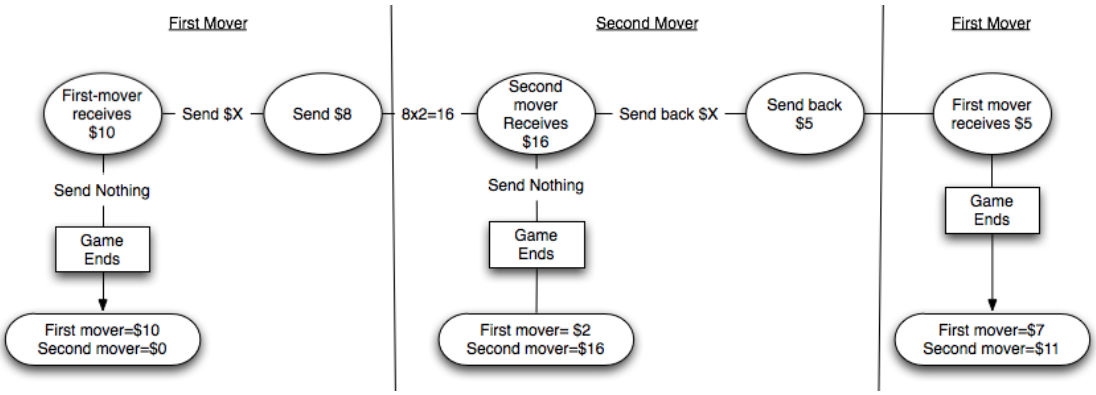
Game 2

In this game, you will be matched anonymously with a partner. You will be randomly assigned the role of either first-mover or second-mover. The first mover will receive 10 experimental dollars. The first-mover must then decide what, if any, portion to send to the second-mover. The amount the first-mover sends will be doubled. The second-mover must then make a similar decision and choose what, if any, portion of the received amount he sends back to the first-mover. However, the amount the second-mover sends is not altered .The game ends after the second-mover makes his/her decision, or if the first-mover decides to send nothing. You will play this game two times, in all.

Let's look at an example. Feel free to follow along on the flowchart below. Assume the first-mover receives 10 EDs. He decides to send 8 EDs to the second mover.

Hence, the first-mover has kept 2 EDs. The 8 EDs send by the first-mover is doubled so that the second-mover receives 16 EDs. The second mover then has 16 EUs, of which he can keep all 16, none, or any integer amount in-between. Suppose he decides to send back 5 EDs. Then the second-mover walks away with the 16 EDs he received minus the 5 that he sent back, which equals 11 earned EDs. The first mover has the 2 that he did not send, plus 5 more that was sent back, making 7 earned EDs. At this point, the game ends.

The exchange rate for this experiment is 0.25, so each ED is worth 0.25 real dollars. If you have any questions, you may ask them now.



Game 3

In this game you will be matched anonymously with two people to form groups of three. Each of you will then choose an E that ranges from 1 through 7. The payoff in this game will depend on the E you choose personally and the lowest chosen E of the group. Specifically, your payoff will equal 50 plus 20 times the lowest E chosen in the group minus 10 times the E you chose personally. This payoff function is shown at the bottom of the page.

Let's look at an example. Suppose you choose an E of 3, and your group members select E's of 2 and 7, respectively. Thus, the lowest E of the group is 2. In this case, your payoff will be 50 plus 20 times the lowest, which is 2, so 40, minus 10 times 3, which was your own E, so 30. So you would earn 50 + 20*2 – 10*3 = 50 + 40 – 30 = 60 experiment dollars. The group member who chose an E of 2 would earn 50 +20*2 – 10*2 = 50 + 40 – 20 = 50 experiment dollars. The group member who chose an E of 7 would earn 50 + 2*20 – 10*7 = 50 + 40 – 70 = 20 experimental dollars.

Let's look at one more example. Assume you choose an E of 5, and your group members choose Es of 6 and 7, respectively. In this case, your own payoff would be 50 + 20*5 – 10*5 = 50 + 100 – 50 = 100 EDs. The team member who chose an E of 6 would earn 50 + 20*5 – 10*6 = 50 + 100 – 60 = 90 EDs. The member who chose 7

would earn 50 + 20*5 – 10*7 = 50 + 100 – 70 = 80 EDs.

As you can see, your payoff increases as the minimum of the group increases, and also when your own E decreases.

Once every member of your group has chosen an E the game ends. You will be shown your payoff and the game will start again. You will then play the game again with the same group. After you have played the game 5 times, you will be re-matched to form a new group of 3 and play the game 5 more times.

On the next page provides a table that you can use to easily see what your payoff would be for different E's. The exchange rate for this experiment is 0.05, so every ED is worth 0.05 real dollars. If you have any questions, you may ask them now.

Payoff Function

$$\pi_i = 50 + 20 * \min[e_1, e_2, e_3] - 10 * e_i$$

	Minimum Group E						
Your E	1	2	3	4	5	6	7
1	**60**	**-**	**-**	**-**	**-**	**-**	**-**
2	**50**	**70**	**-**	**-**	**-**	**-**	**-**
3	**40**	**60**	**80**	**-**	**-**	**-**	**-**
4	**30**	**50**	**70**	**90**	**-**	**-**	**-**
5	**20**	**40**	**60**	**80**	**100**	**-**	**-**
6	**10**	**30**	**50**	**70**	**90**	**110**	**-**
7	**0**	**20**	**40**	**60**	**80**	**100**	**120**

Game 4

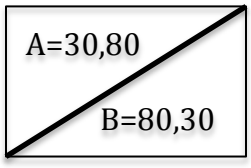
In this game, you will be matched anonymously with a partner and alternate in playing the roles of Sender and Receiver. Each round there are two prizes, A and B,

which contain payoffs for each player. The Sender is given information regarding the prizes. The Sender can then send the receiver one of two messages. The messages will say either “Prize A earns the Sender more than the Receiver" or "Prize B earns the Sender more than the Receiver”. After the Sender decides which message to send, the receiver decides which of the prizes to choose. Hence, the Receiver determines the payoffs because he selects the prize, but information about the prizes is known and communicated by the Sender. Prize B is always the reverse of Prize A, so if A gives the Sender 70, B will give the Receiver 70, and so on.

Let’s look at an example. Suppose, after being partnered, you are given the role of Sender. You see two prizes, A and B. Prize A gives the Sender 30 and gives the Receiver 80. Prize B gives the Sender 80 units and the Receiver 30. You can then send the Receiver one of two messages. Message 1 says, “Prize A earns the Sender more than the Receiver.” Message 2 says, “Prize B earns the Sender more than the Receiver.” Suppose you decide to send Message 2. Your decision making in the game is now finished.

If you are the Receiver, this is the beginning of your decision-making. You see Message 2, which, if you recall, says, “Prize B earns the Sender more than the Receiver.” It is now up to you to choose either prize A or prize B, that is, it is up to you to decide whether or not to believe the message. After you make your decision, the payoffs are revealed to both you and your partner and the game ends. You are then matched with a new partner and this process is repeated. You will play this game a total of 16 times, 8 times as the Sender and 8 times as the Receiver.

The exchange rate for this game is 0.05, so each ED is worth 0.05 real dollars. If you have any questions, you may ask them now.

Sender		Receiver
1) 	choose Prize A or Prize B	1) Observe message and

Key: A=Sender, B=Receiver

2) M1: Prize A earns the Sender more than the Receiver
M2: Prize B earns the Sender more than the Receiver

Conclusion of Session

The lab session is now complete. You may communicate with your fellow participants as you please. Please come and exchange your experimental dollars for real dollars and have a nice day. As a final request, we ask that you do not discuss the nature of the experiment with others in case they participate in the experiment in the future.

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